

## CLAIMS

What is claimed is:

1. A ground plane beam antenna for transmitting and/or receiving radio frequency (RF) signals, said antenna comprising:
  - at least one parasitic reflector element having a first end and a second end;
  - at least one parasitic director element having a first end and a second end;
  - a driven element positioned co-linearly with and between said at least one reflector element and said at least one director element; and
  - an electrically conductive ground plane being electrically connected to said at least one reflector element and said at least one director element at said second ends, and being electrically isolated from said driven element.
2. The antenna of claim 1 wherein said driven element comprises at least two radiative members each having a first end and a second end, and wherein said second ends of said radiative members are electrically connected at an apex point and are each disposed outwardly away from said apex point at an acute angle relative to and on a first side of an imaginary plane intersecting said apex point.
3. The antenna of claim 1 further comprising a dielectric material serving to mechanically connect, at least in part, said driven element to said ground plane while electrically insulating said driven element from said ground plane.
4. The antenna of claim 3 further comprising an electrical conductor electrically connected to said driven element at said apex point and extending away from said apex point toward a ground plane side of said antenna through said dielectric material to allow connection to a transmission line for interfacing said driven element to a radio frequency transmitter and/or receiver.

5. The antenna of claim 1 further comprising an electrical connector to allow connection of said driven element and said ground plane to a transmission line.
6. The antenna of claim 2 wherein said ground plane comprises a substantially rectangular, first electrically conductive sheet having a width of about  $\frac{1}{4}$  wavelength of a tuned radio frequency and being substantially parallel to said imaginary plane.
7. The antenna of claim 6 wherein said ground plane further comprises substantially rectangular second and third electrically conductive sheets, each having a width of about  $\frac{1}{4}$  wavelength of said tuned radio frequency, each being substantially the same length as said first conductive sheet, said second conductive sheet having a first lengthwise edge that is mechanically and electrically connected to a first lengthwise edge of said first conductive sheet and forming an angle with respect to said first conductive sheet, and said third conductive sheet having a first lengthwise edge that is mechanically and electrically connected to a second lengthwise edge of said first conductive sheet and forming an angle with respect to said first conductive sheet.
8. The antenna of claim 7 wherein one-half the width of said first conductive sheet plus the full width of said second conductive sheet or said third conductive sheet is at least one-quarter of a wavelength.
9. The antenna of claim 2 wherein each of said radiative members are substantially linear and have a physical length determined by a pre-defined radio frequency.
10. The antenna of claim 1 wherein said reflector element and said at least one director elements are substantially linear.
11. The antenna of claim 2 wherein said acute angle between each of said radiative members and said ground plane is between 1 degree and 89 degrees.
12. The antenna of claim 1 further comprising a reflector plate being positioned at a reflector element end of said ground plane, being substantially perpendicular to said

ground plane, and being mechanically and electrically connected to said ground plane.

13. The antenna of claim 2 wherein said radiative members are equally spaced in angle circumferentially around 360 degrees.
14. The antenna of claim 7 wherein said angle is between zero degrees and 180 degrees.
15. A method to construct a ground plane beam antenna for transmitting and/or receiving radio frequency (RF) signals, said method comprising:

generating a driven element that is tuned to at least one predetermined radio frequency;

generating at least one linear, parasitic reflector element having a first end and a second end and having an initial length based on, at least in part, said tuned driven element;

generating at least one linear, parasitic director element having a first end and a second end and having an initial length based on, at least in part, said tuned driven element;

positioning said driven element co-linearly with and between said at least one reflector element and said at least one director element;

generating an electrically conductive ground plane; and

electrically connecting said ground plane to said second ends of said reflector element and said at least one director element and keeping said ground plane electrically isolated from said driven element.

16. The method of claim 15 wherein said driven element comprises at least two radiative members each having a first end and a second end and wherein said second ends of said radiative members are electrically and mechanically connected at an apex point

such that each radiative member is disposed outwardly away from said apex point at an acute angle relative to and on a first side of an imaginary plane intersecting said apex point.

17. The method of claim 15 further comprising adjusting said initial lengths of at least one of said at least one reflector element, said driven element, and said at least one director element based on a diameter of at least one of said elements.
18. The method of claim 15 further comprising adjusting said initial lengths of at least one of said at least one reflector element, said at least one director element, and said driven element based on an analysis of electro-magnetic interactions between said elements.
19. The method of claim 16 wherein generating said tuned driven element comprises cutting each of said radiative members to a physical length corresponding to said at least one predetermined radio frequency.
20. The method of claim 16 further comprising mechanically connecting said driven element to said ground plane using at least a dielectric material to electrically insulate said driven element from said ground plane.
21. The method of claim 20 further comprising connecting an electrical conductor to said driven element at said apex point such that said electrical conductor extends away from said apex point toward a ground plane side of said antenna and through said dielectric material to allow connection to a transmission line for interfacing said driven element to a radio frequency transmitter and/or receiver.
22. The method of claim 15 further comprising connecting an electrical connector to said driven element and said ground plane to allow connection of said antenna to a transmission line.

23. The method of claim 16 wherein said ground plane comprises a substantially rectangular, first electrically conductive sheet having a width of about  $\frac{1}{4}$  wavelength of said at least one predetermined radio frequency and being substantially parallel to said imaginary plane.
24. The method of claim 23 wherein said ground plane further comprises substantially rectangular second and third electrically conductive sheets, each having a width of about  $\frac{1}{4}$  wavelength of said at least one predetermined radio frequency, each being substantially the same length as said first conductive sheet, said second conductive sheet having a first lengthwise edge that is mechanically and electrically connected to a first lengthwise edge of said first conductive sheet and forming an angle with respect to said first conductive sheet, and said third conductive sheet having a first lengthwise edge that is mechanically and electrically connected to a second lengthwise edge of said first conductive sheet and forming an angle with respect to said first conductive sheet.
25. The method of claim 24 wherein one-half the width of said first conductive sheet plus the full width of said second conductive sheet or said third conductive sheet is at least one-quarter of a wavelength.
26. The method of claim 16 wherein said at least one predetermined radio frequency is substantially the same for each of said radiative members.
27. The method of claim 16 wherein said at least one predetermined radio frequency is substantially different for each of said radiative members.
28. The method of claim 16 wherein an angle between each of said radiative members and said ground plane is between 1 degree and 89 degrees.
29. The method of claim 15 further comprising positioning a reflector plate at a reflector element end of said ground plane and substantially perpendicular to said ground plane, and being mechanically and electrically connected to said ground plane.

30. The method of claim 16 wherein said radiative members are equally spaced in angle circumferentially around 360 degrees.
31. The method of claim 15 wherein a first spacing between a first odd numbered director element  $D_{\text{odd}}$  of said at least one director element and an adjacent even numbered director element  $D_{\text{odd}-1}$  of said at least one director element is greater than a second spacing between said even numbered director element  $D_{\text{odd}-1}$  and an adjacent second odd numbered director element  $D_{\text{odd}-2}$  of said at least one director element.
32. The method of claim 15 wherein a first difference in length between a first odd numbered director element  $D_{\text{odd}}$  of said at least one director element and an adjacent even numbered director element  $D_{\text{odd}-1}$  of said at least one director element is less than one-half a second difference in length between a second odd numbered director element  $D_{\text{odd}-2}$  of said at least one director element and said adjacent even numbered director element  $D_{\text{odd}-1}$ .
33. The method of claim 15 wherein a first linear spacing between a first odd numbered director element  $D_{\text{odd}}$  of said at least one director element and an adjacent even numbered director element  $D_{\text{odd}-1}$  of said at least one director element increases as  $D_{\text{odd}}$  is further in linear distance from said driven element.
34. The method of claim 33 wherein a second linear spacing between a second odd numbered director element  $D_{\text{odd}-2}$  of said at least one director element and said adjacent even numbered director element  $D_{\text{odd}-1}$  increases as  $D_{\text{odd}-2}$  is further in linear distance from said driven element.
35. The method of claim 15 wherein a length of an odd numbered director element  $D_{\text{odd}}$  of said at least one director element is greater than a length of a first adjacent even numbered director element  $D_{\text{odd}-1}$  of said at least one director element, and a length of a second adjacent even numbered director element  $D_{\text{odd}+1}$  of said at least one director

element is less than said length of said first adjacent even numbered director element  $D_{\text{odd}-1}$ .

36. A stacked configuration of antennas for improving gain along a particular spatial dimension, said stacked configuration comprising at least two ground plane beam antennas positioned in spatial proximity to each other and having substantially the same spatial orientation, and said antennas each comprising at least one parasitic reflector element having a first end and a second end, at least one parasitic director element having a first end and a second end, a driven element positioned co-linearly with and between said reflector element and said at least one director element, and an electrically conductive ground plane connected to said reflector element and said at least one director element at said second ends, and being electrically isolated from said driven element.
37. The stacked configuration of claim 36 wherein similar ends of four of said at least two ground plane beam antennas are substantially at the four corners of an imaginary rectangle.
38. The stacked configuration of claim 36 wherein said at least two ground plane beam antennas are substantially co-linear.
39. The stacked configuration of claim 36 wherein said driven element comprises at least two radiative members each having a first end and a second end, and wherein said second ends of said radiative members are electrically connected at an apex point and are each disposed outwardly away from said apex point at an acute angle relative to and on a first side of an imaginary plane intersecting said apex point.
40. The stacked configuration of claim 36 wherein a spatial separation distance between any two adjacent antennas of said at least two ground plane beam antennas is between about  $2/3$  of a wavelength and about 3 wavelengths of a predetermined radio frequency carrier signal.

41. The stacked configuration of claim 36 further comprising a common reflector plate positioned to a reflector element side of said at least two ground plane beam antennas and being substantially perpendicular to a length-wise dimension of said at least two ground plane beam antennas, and said reflector plate being electrically connected to each ground plane of said at least two ground plane beam antennas.
42. An antenna configuration for transmitting and/or receiving radio frequency (RF) signals, said configuration comprising:
- a conductive reflector plate;
  - a first ground plane beam antenna being mounted onto a first side of said conductive reflector plate such that RF radiation from said first ground plane beam antenna is directed substantially perpendicular to and away from said first side of said conductive reflector plate;
  - a second ground plane beam antenna, being substantially identical to said first ground plane beam antenna, and being mounted onto said first side of said reflector plate such that RF radiation from said second ground plane beam antenna is directed substantially perpendicular to and away from said first side of said conductive reflector plate; and
  - a two-port power divider to feed a radio frequency signal in phase to both said first ground plane beam antenna and said second ground plane beam antenna, and to combine radio frequency signals received from both said first ground plane beam antenna and said second ground plane beam antenna.
43. The configuration of claim 42 wherein said first ground plane beam antenna and said second ground plane beam antenna each comprise at least one parasitic reflector element having a first end and a second end, at least one parasitic director element having a first end and a second end, a driven element positioned co-linearly with and between said reflector element and said at least one director element, and an



electrically conductive ground plane being electrically connected to said reflector element and said at least one director element at said second ends and being electrically isolated from said driven element.

44. The configuration of claim 43 wherein said conductive ground planes of both said first ground plane beam antenna and said second ground plane beam antenna are electrically connected to said reflector plate.
45. The configuration of claim 43 wherein said driven element comprises at least two radiative members each having a first end and a second end, and wherein said second ends of said radiative members are electrically connected at an apex point and are each disposed outwardly away from said apex point at an acute angle relative to and on a first side of an imaginary plane intersecting said apex point.
46. The configuration of claim 43 further comprising two electrical connectors to allow electrical connection of said radiative members and said ground plane of each of said ground plane beam antennas to said two-port power divider.
47. The configuration of claim 45 wherein said first and second ground plane beam antennas are oriented with respect to each other such that said apex points of said driven elements of said first and second ground plane beam antennas are separated by a predetermined distance based on, at least in part, a predetermined radio frequency of operation, and such that said imaginary planes intersecting said apex points are perpendicular to each other.
48. The configuration of claim 45 wherein each of said radiative members are substantially linear and have a physical length determined by, at least in part, a pre-defined radio frequency of operation.
49. The configuration of claim 45 wherein said acute angle between each of said radiative members and said imaginary plane is between 1 degree and 89 degrees.

50. The configuration of claim 45 wherein said radiative members are equally spaced in angle circumferentially around 360 degrees.
51. A multi-polarized beam antenna for transmitting and/or receiving radio frequency (RF) signals, said configuration comprising:
- at least one electrically conductive parasitic element; and
  - a multi-polarized driven element positioned co-linearly with said at least one parasitic element.
52. The antenna of claim 51 further comprising a reflector plate positioned to one side of said at least one parasitic element and said driven element such that a planar surface of said reflector plate is substantially perpendicular to an imaginary line passing through said co-linearly positioned elements.
53. The antenna of claim 51 wherein said multi-polarized driven element comprises at least two radiative members each having a first end and a second end, and wherein said second ends of said radiative members are electrically connected at an apex point and are each disposed outwardly away from said apex point at an acute angle relative to and on a first side of an imaginary plane intersecting said apex point.